



Latest ICESat Calibration Results From Integrated Residual Analysis

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NASA/GSFC**

**Presented at ICESat Science Team Meeting
October 14, 2005
Boulder, CO**



Introduction

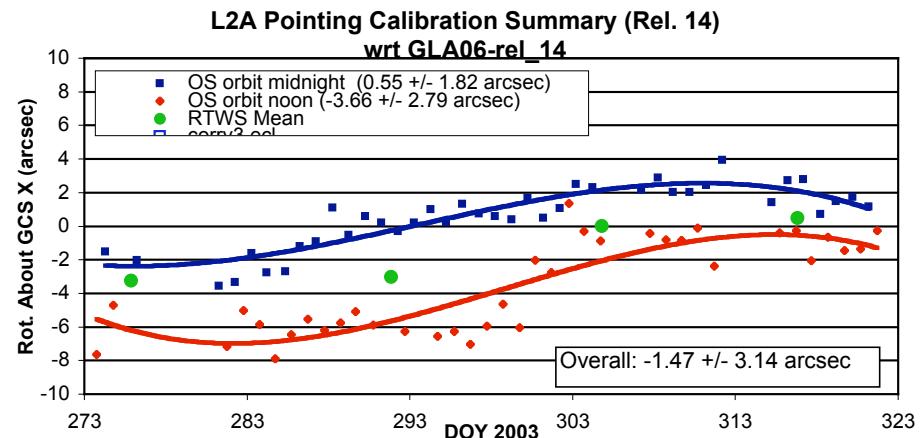
- Summary of L3A performance:
 - Rel. 18, 22, 23
 - Scan Maneuver (SM) calibrations and corrections
 - Ranging performance
 - Xover performance
- L2B: Rel. 22
 - Initial performance analysis
- Pointing impact on L3a - L2a ice sheet dh/dt
 - L2A Rel. 21 and L3A Rel. 18
 - L2A Rel. 21 and L3A Rel. 18' (preliminary SM correction)
 - L2A Rel. 21 and L3A Rel. 23



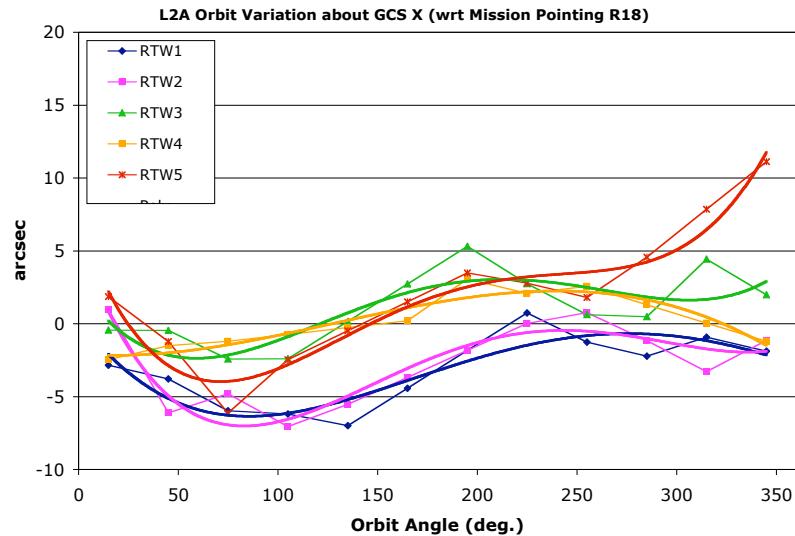
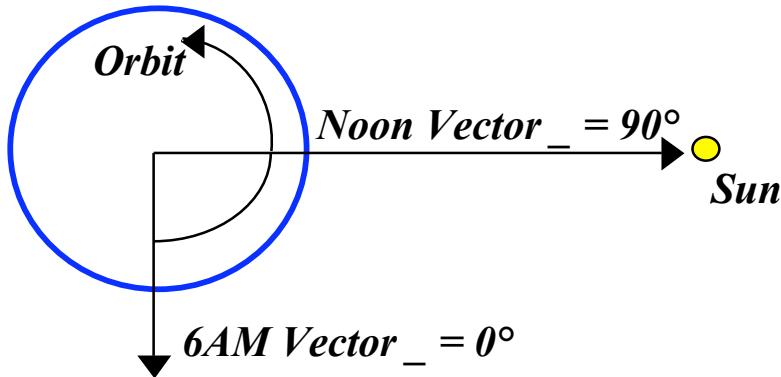
SM calibrations: orbital variations and bias trends

Using OSs capture pointing bias trends and orbital variation about both GCS X and Y

L2A GCS X Example



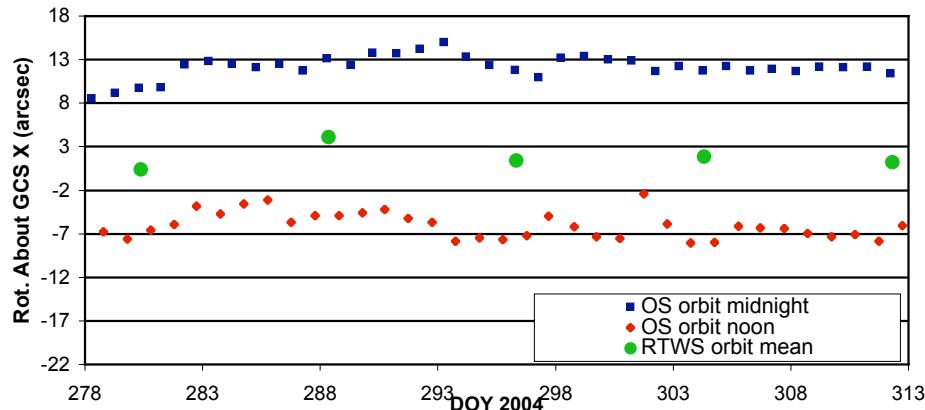
Using RTWSs estimate orbital pointing variation as a step function in orbit angle for both GCS X and Y



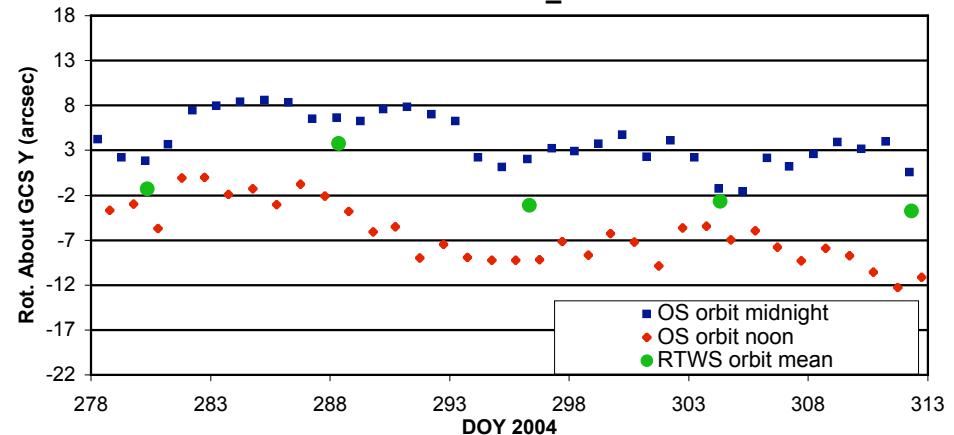


L3A OS Calibration Summary

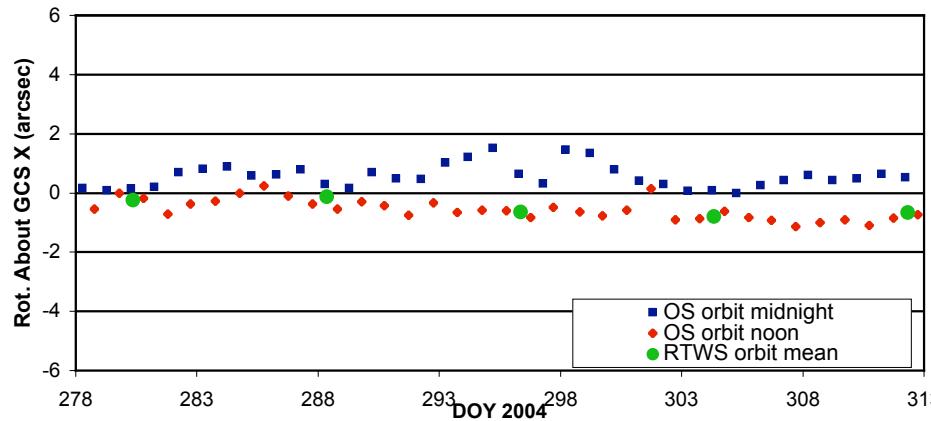
L3A Pointing Calibration Summary (about GCS X)
wrt GLA06-rel_18



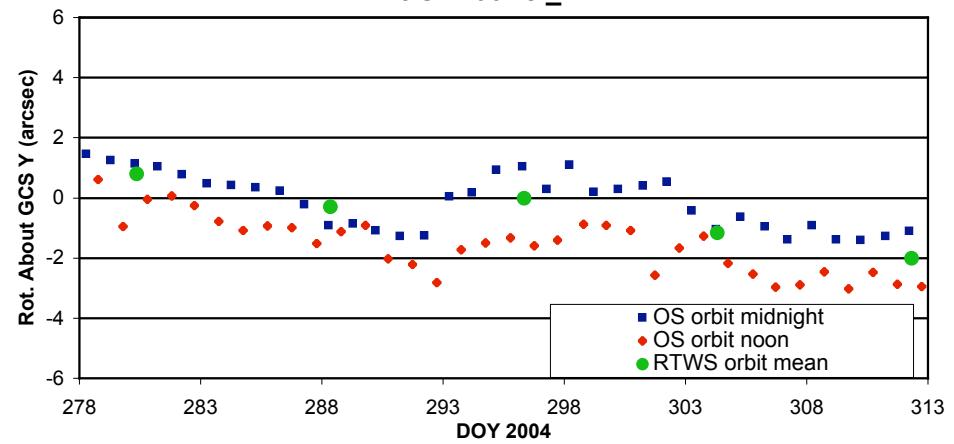
L3A Pointing Calibration Summary (about GCS Y)
wrt GLA06-rel_18



L3A Pointing Calibration Summary (about GCS X)
wrt GLA06-rel_22

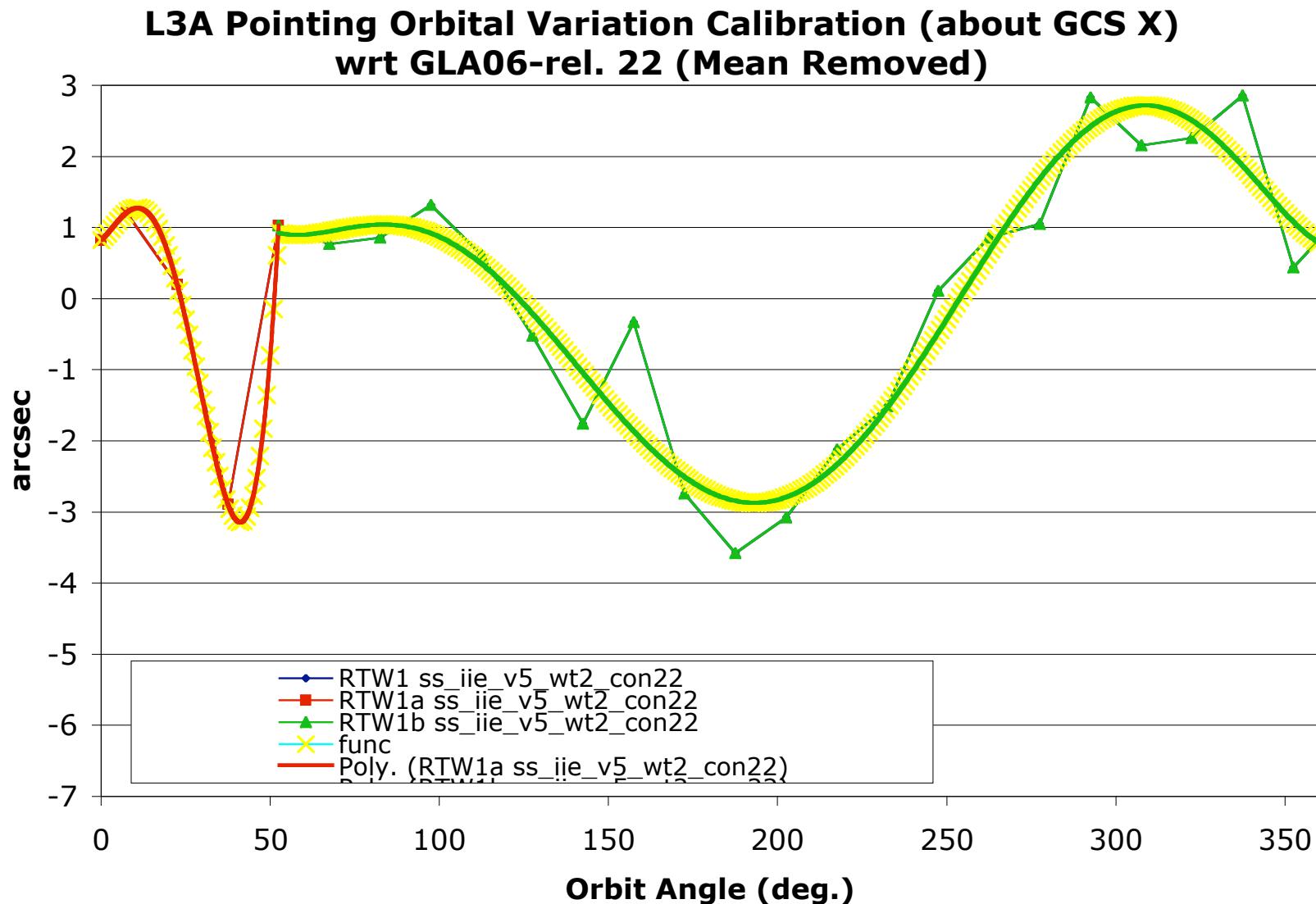


L3A Pointing Calibration Summary (about GCS Y)
wrt GLA06-rel_22





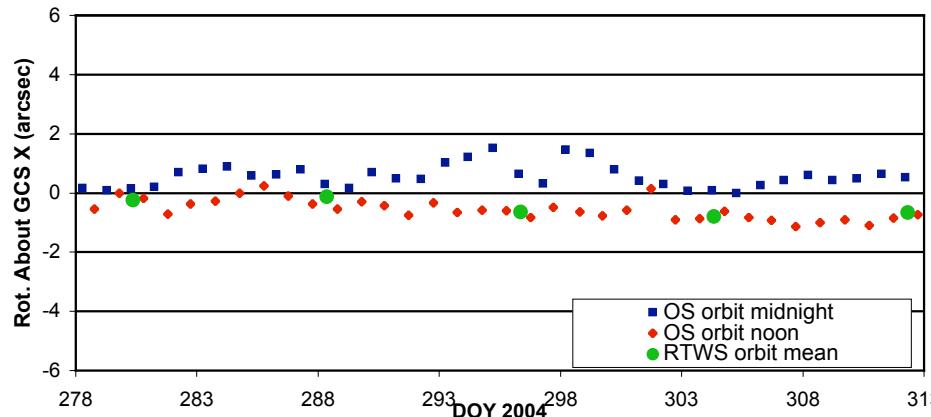
L3A RTWS Example



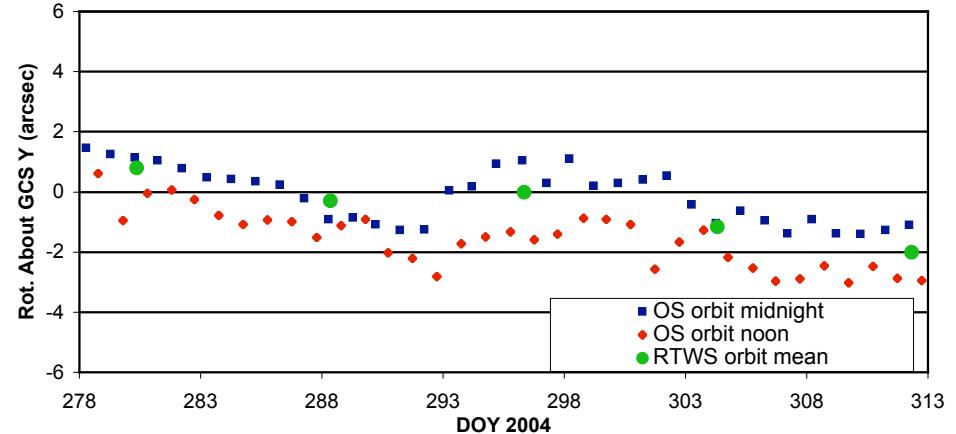


L3A OS Calibration Summary

L3A Pointing Calibration Summary (about GCS X)
wrt GLA06-rel_22

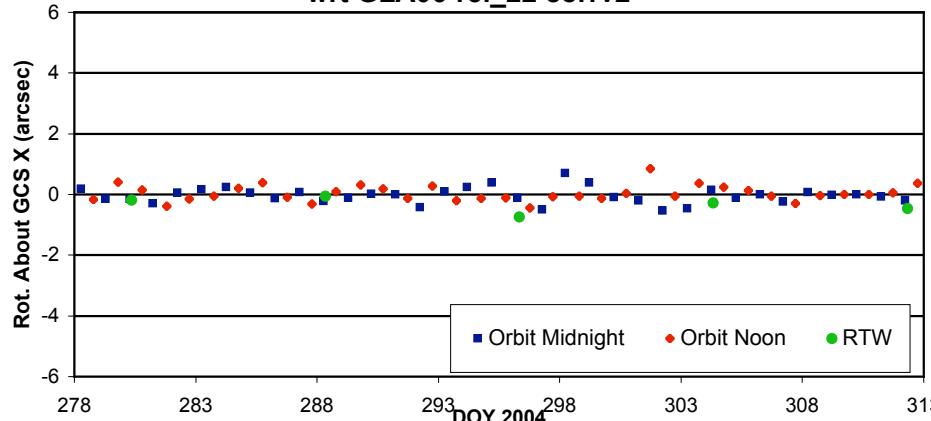


L3A Pointing Calibration Summary (about GCS Y)
wrt GLA06-rel_22

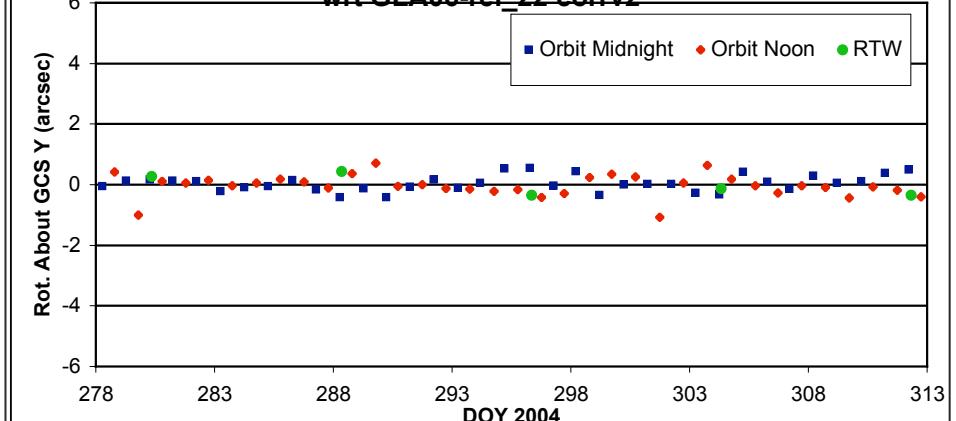


Rel. 22; about GCS X = 0.00 ± 0.67 arcsec ; GCS Y = -0.84 ± 1.19 arcsec

L3A Pointing Calibration Summary (Rot. about GCS X)
wrt GLA06-rel_22 corrv2



L3A Pointing Calibration Summary (Rot. about GCS Y)
wrt GLA06-rel_22 corrv2

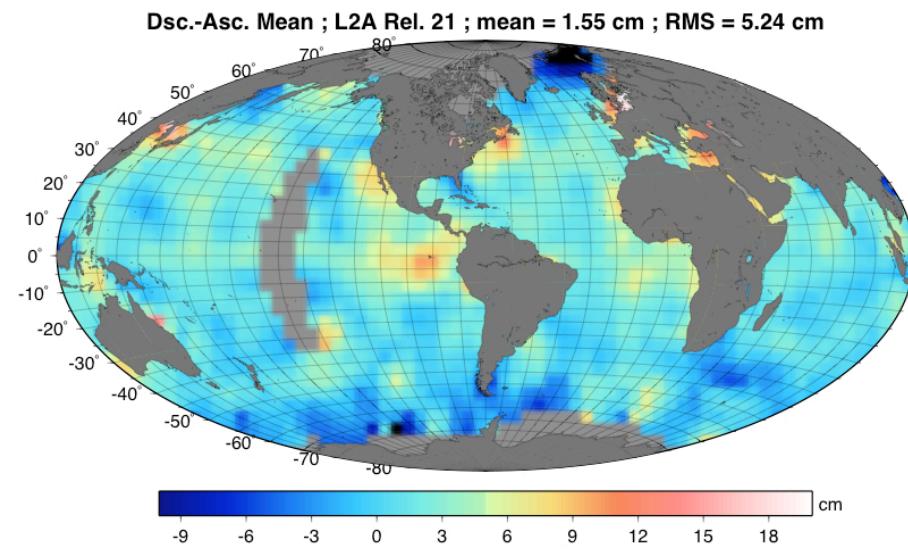
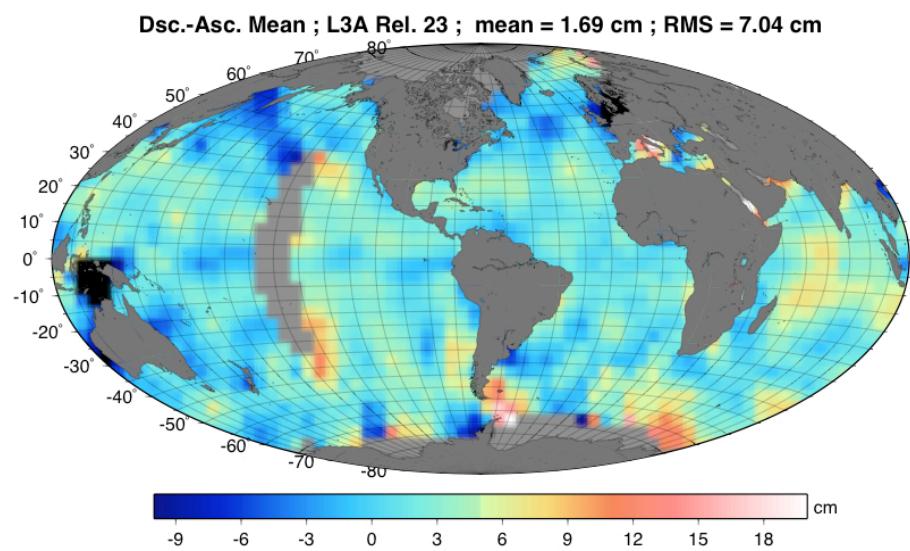
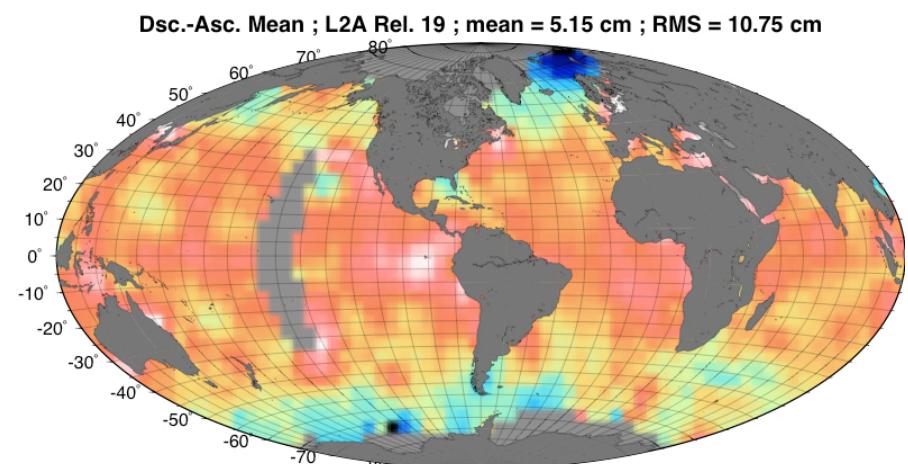
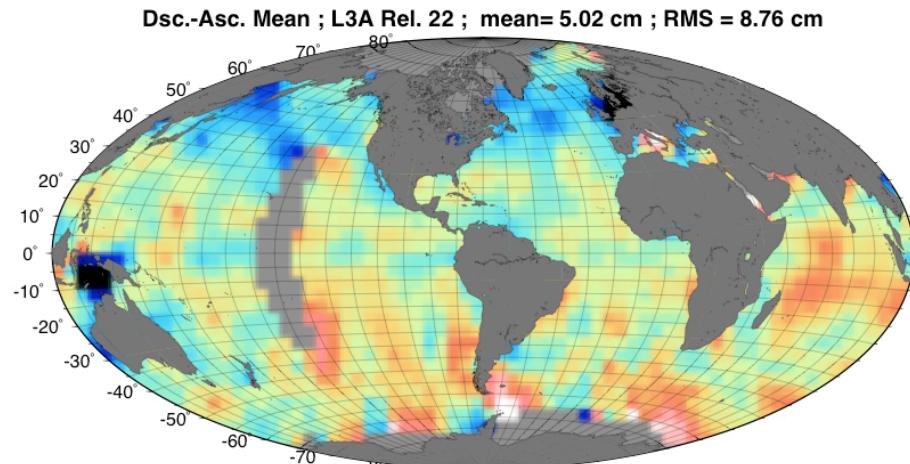


Rel. 23; about GCS X = 0.00 ± 0.26 arcsec ; GCS Y = 0.00 ± 0.32 arcsec



Descending - Ascending Sea Surface Anomalies

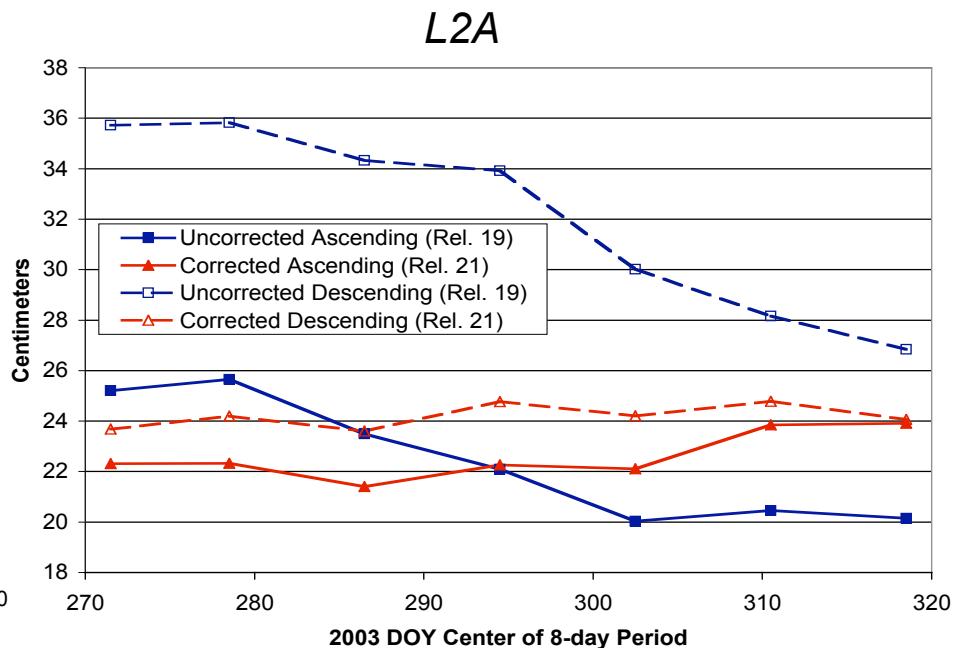
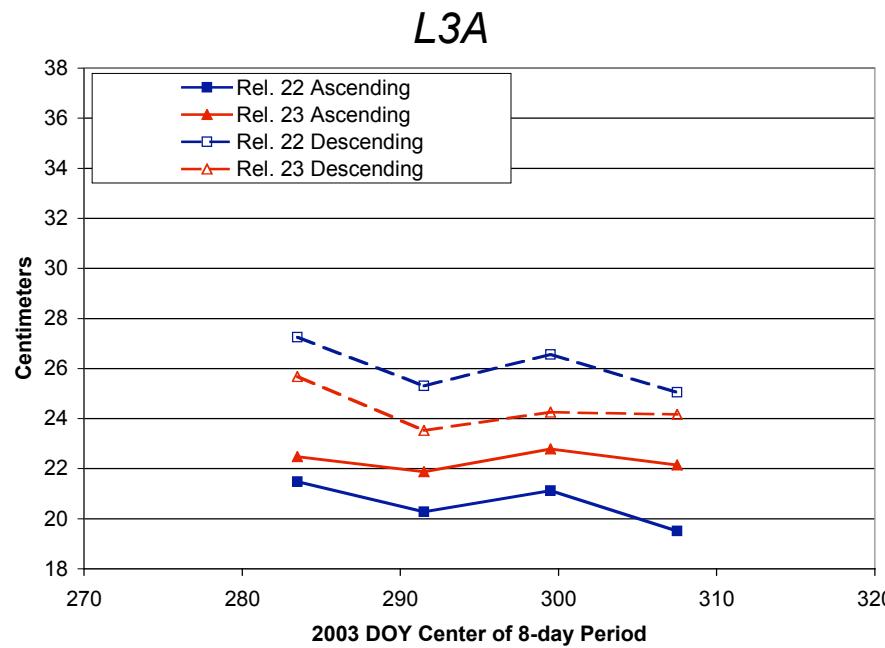
Difference between descending and ascending altimeter derived sea surface anomalies (SSA) before (top; rel. 22 for L3A and rel. 19 for L2A) and after SM derived correction is applied (bottom; rel. 23 for L3A and rel. 21 for L2A).





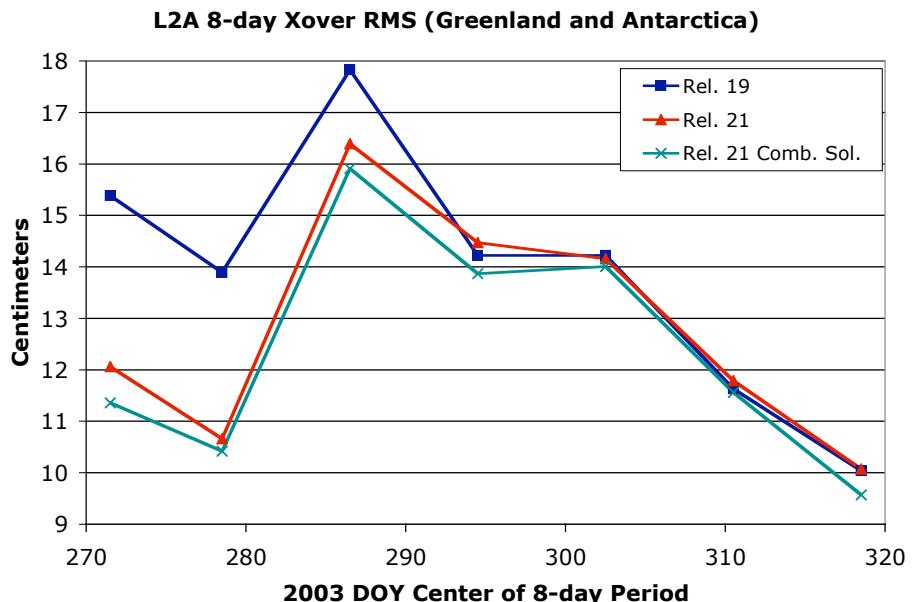
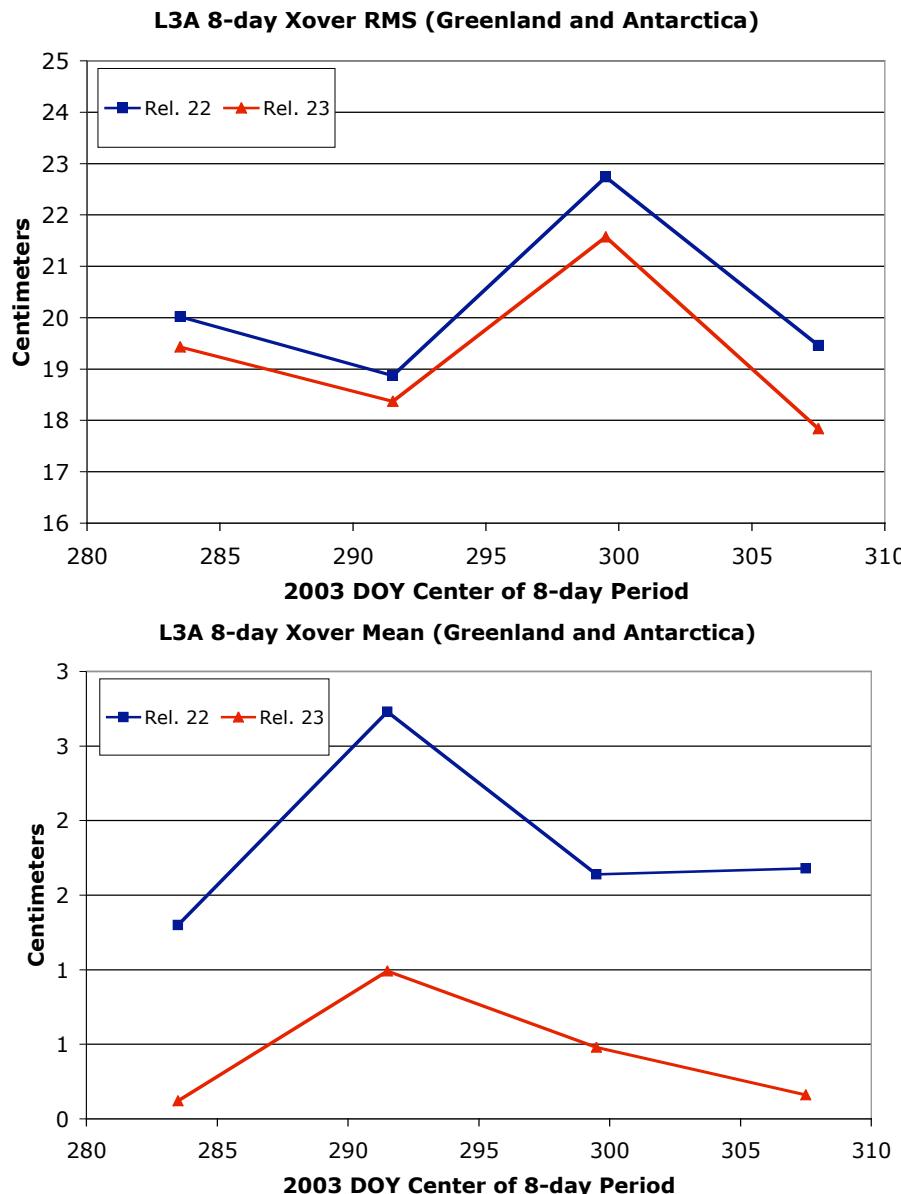
Global Range Bias Estimate

Range bias formally estimated using ~nadir ocean altimeter range observations, GSFCMSS00, GOT00 Tides, and IB.





Ice Sheet Xover Performance



While L3A Xover performance has improved with Rel. 23, they remain significantly worse than L2A.



Ice Sheet Xover Summary (8-day xover, <0.6 deg. slope)

Centimeters	Antarctica			Greenland		
	mean	stdev	%ΔVar.	mean	stdev	%ΔVar.
L2A						
rel19	0.28	13.77	from rel19	0.24	18.18	from rel19
rel21	-0.25	12.90	-12.15	0.39	16.36	-19.00
rel21*	-0.30	12.48	-17.84	1.00	14.63	-35.24
L3A						
rel22	1.76	20.18	from rel22	6.93	25.25	from rel22
rel23	0.34	19.38	-7.70	5.91	22.47	-20.78
L2B						
rel22	0.40	12.03		4.24	18.60	

L3A represents > 50% increase in variance over L2A

L2B overall is similar to L2A, but further refinements will be explored especially for Greenland.

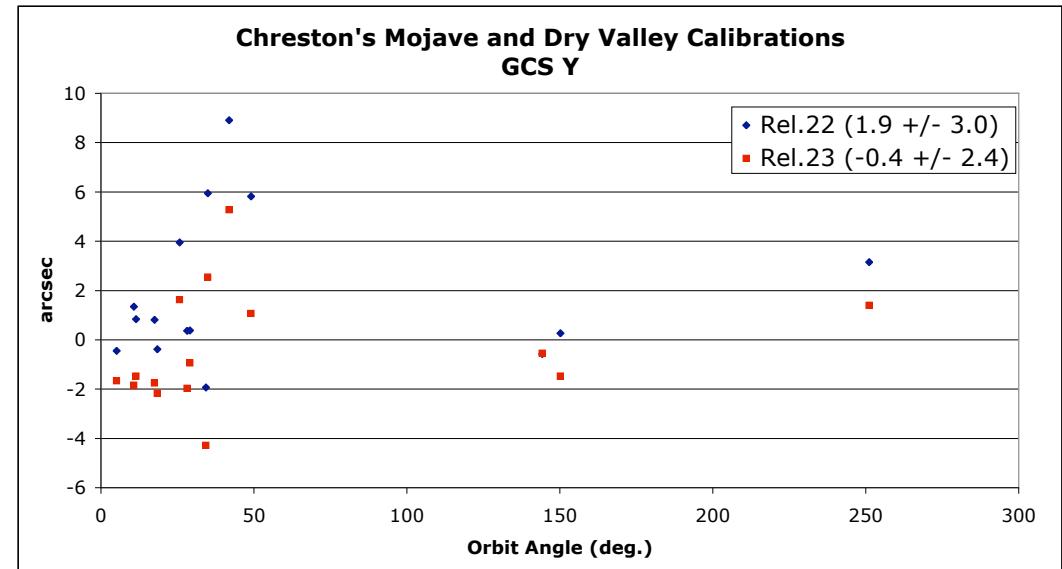
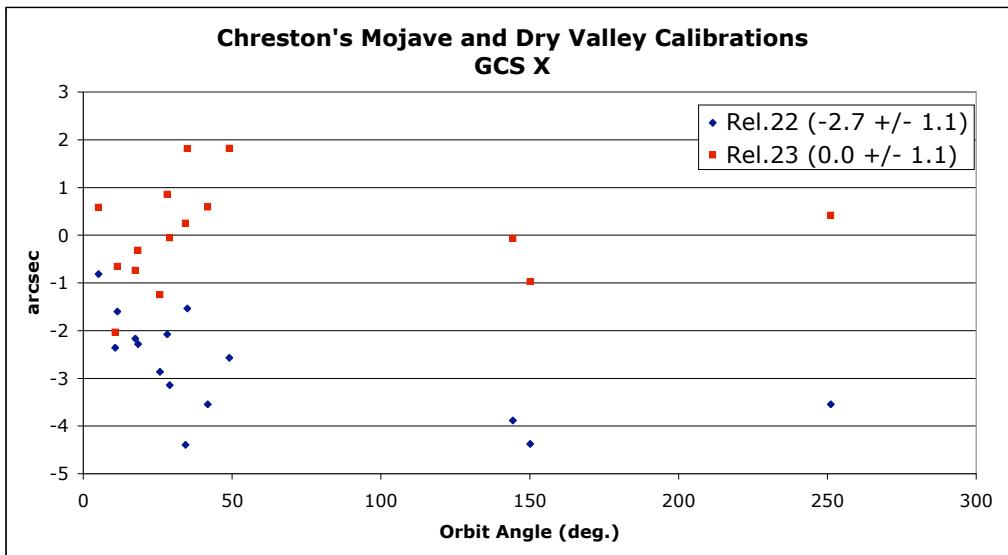


Improvement seen in Helen's Uyuni Test

Centimeters	Rel. 22	Rel. 23
Track 85		
Before sat. correc.	-16.9 ± 3.9	1.4 ± 3.9
After sat. correc.	-13.6 ± 2.8	4.9 ± 2.6
Track 360		
Before sat. correc.	-12.0 ± 4.6	-0.3 ± 4.6
After sat. correc.	-11.1 ± 3.9	0.5 ± 3.9



Improvement seen in Chreston's Mojave and Dry Valley Tests





L3A Problem

Previous charts demonstrate reduction of orbital and bias trend pointing errors. Post-correction results (L2A Rel. 21 and L3A Rel. 23) are very similar between L2A and L3A.

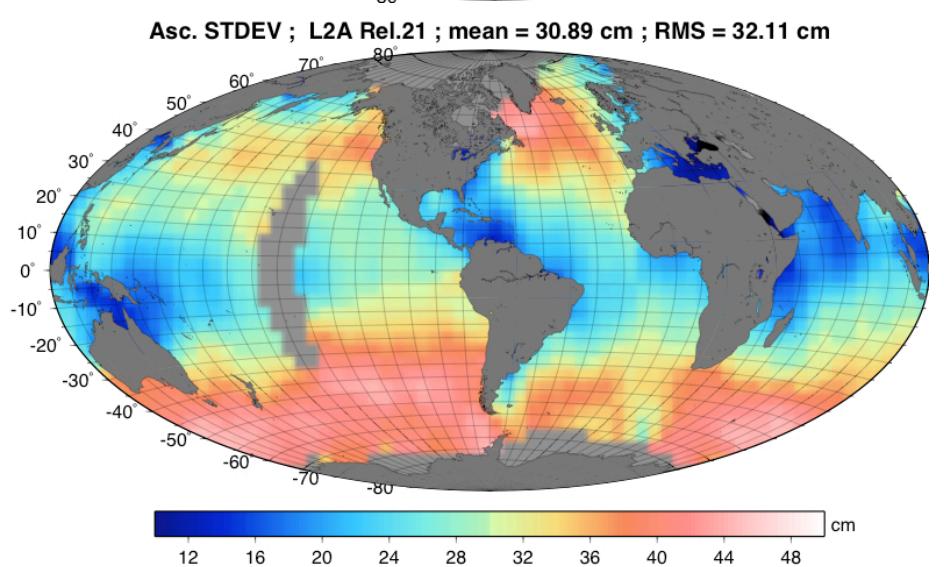
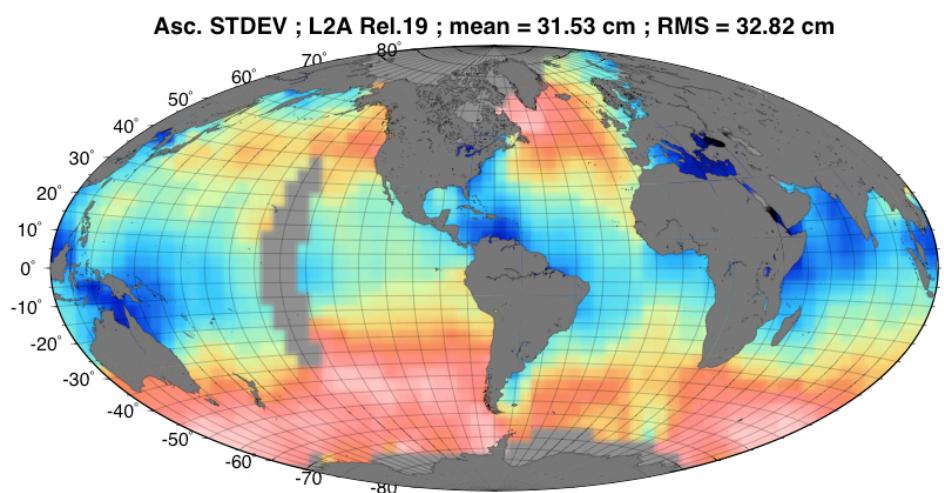
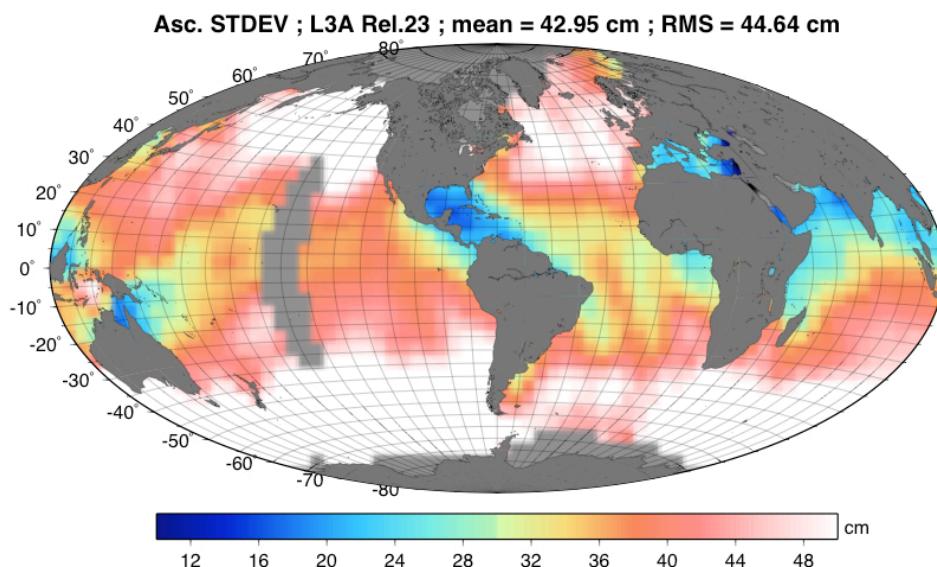
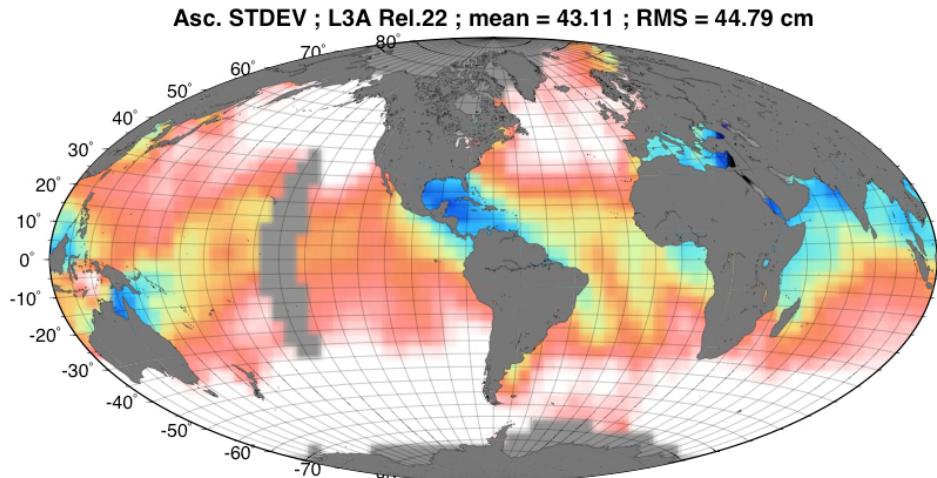
However, gridded standard deviation of ocean range residuals (standard deviation of the range residuals within a geographic 5X5 deg. grid cell) suggest a significant degradation in performance of L3A over L2A (see next two charts). Examination of in-land seas (e.g. Mediterranean) and the global increase suggest this may not be due simply to increased sea state during L3A.

Ice sheet crossover performance and the next two charts suggest there is an increase in “high frequency” error in L3A over L2A.



Gridded Ascending Ocean Range Residual STDEV

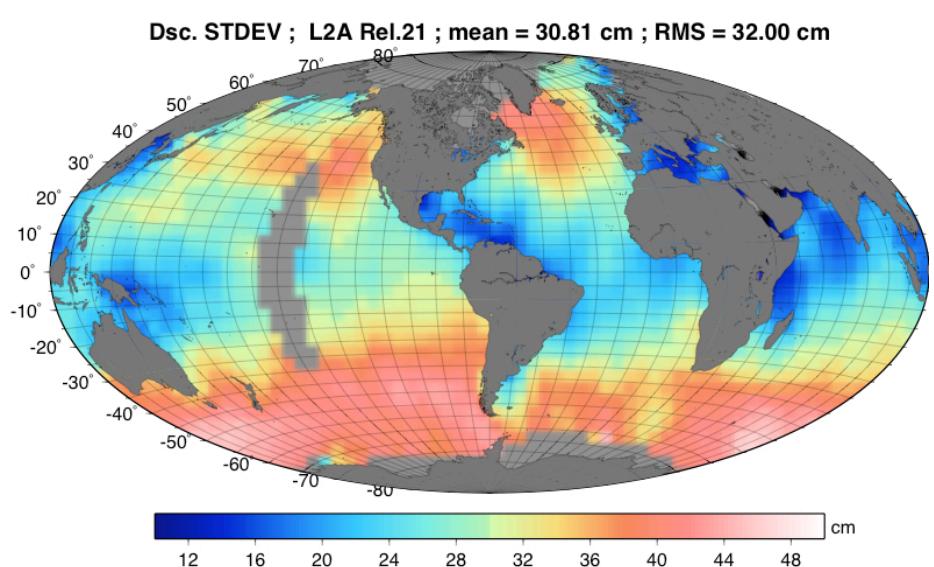
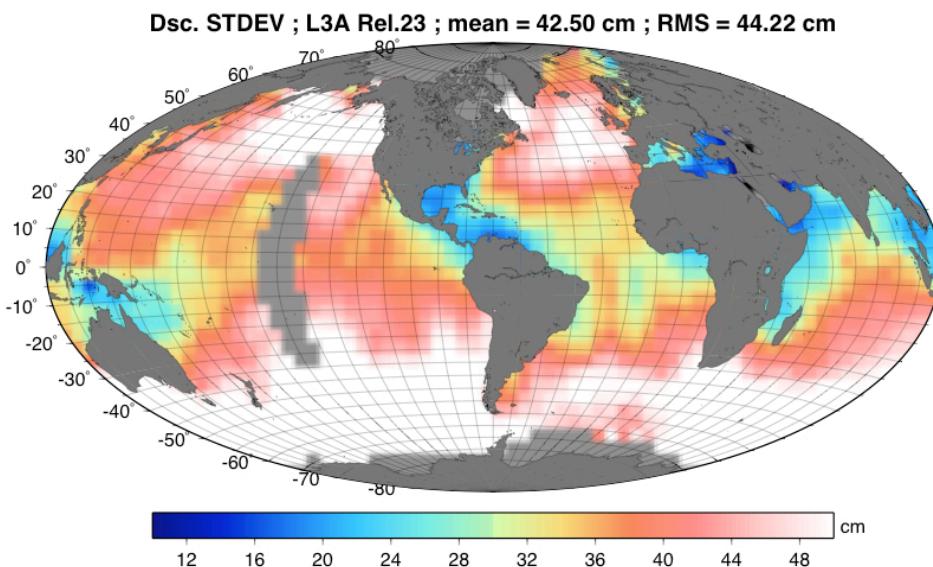
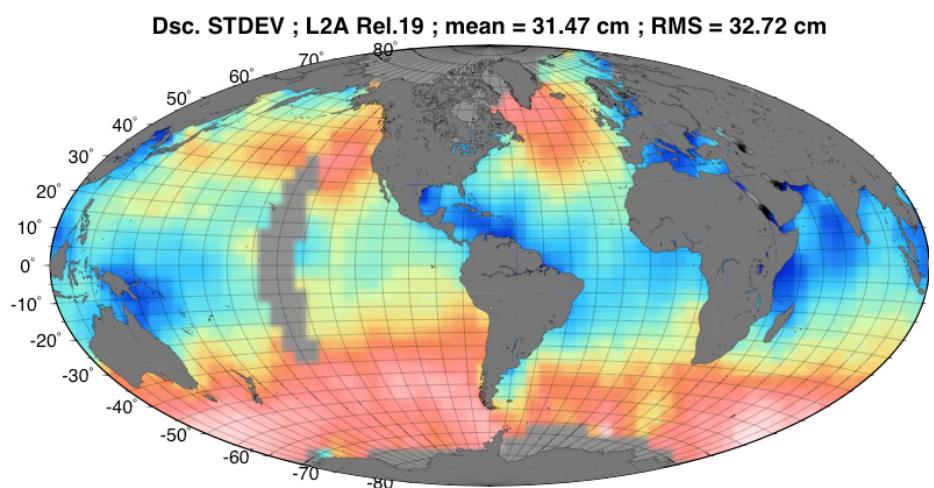
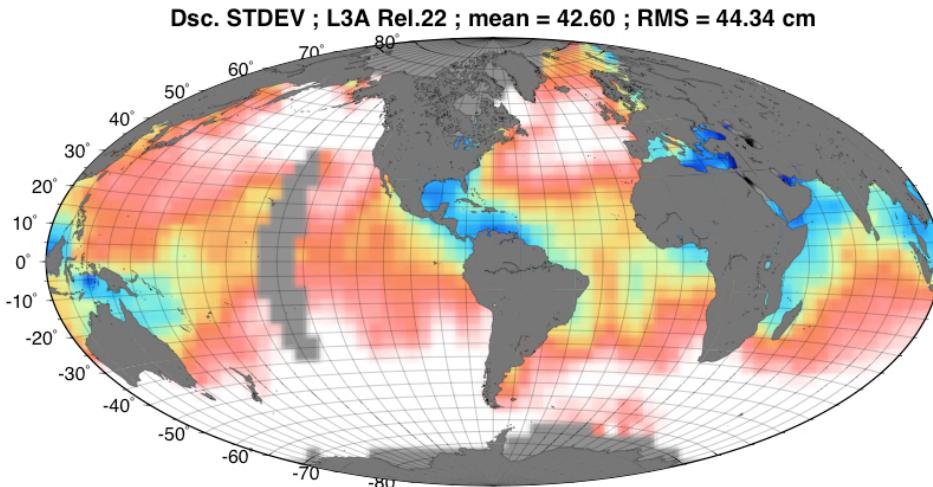
Gridded standard deviation of ocean range residuals from ascending tracks...





Gridded Descending Ocean Range Residual STDEV

Gridded standard deviation of ocean range residuals from descending tracks...





L3A Current Status Summary

In addition to the results presented, I have performed the following experiments:

- 1) *Using Antarctica Xovers only estimate 1CPR pointing every day.*
- 2) *Using Antarctica Xovers only estimate pointing every 7.5 deg. in orbit angle*

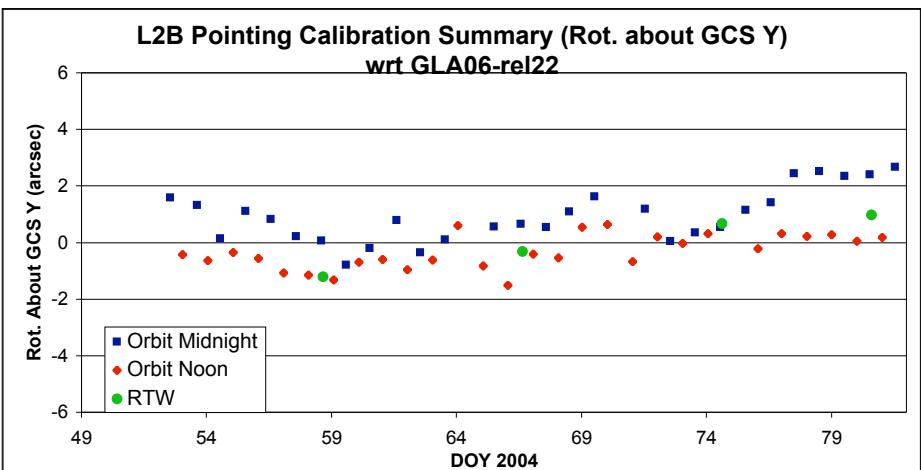
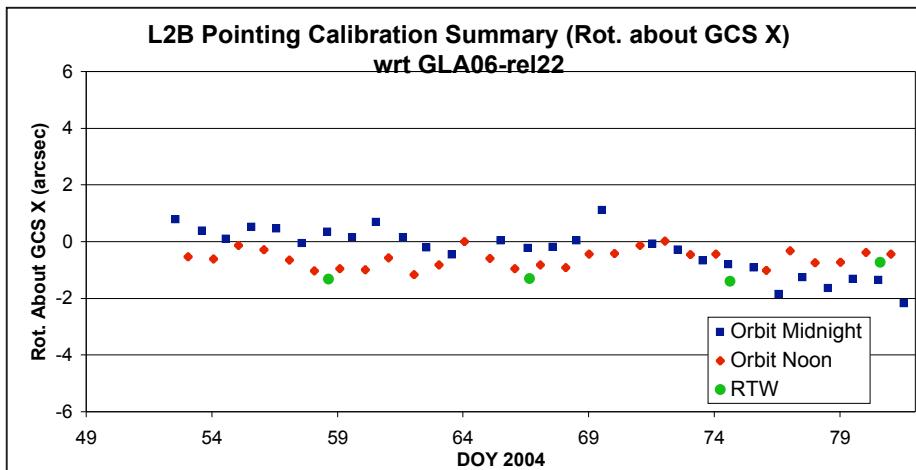
Neither of the above has resulted in any significant improvement in the ice sheet xover performance.

The results presented, coupled with the above experiment results, suggest that we have a significant ~“high-frequency” (~period of less than 230 s) error source remaining in the L3A data.

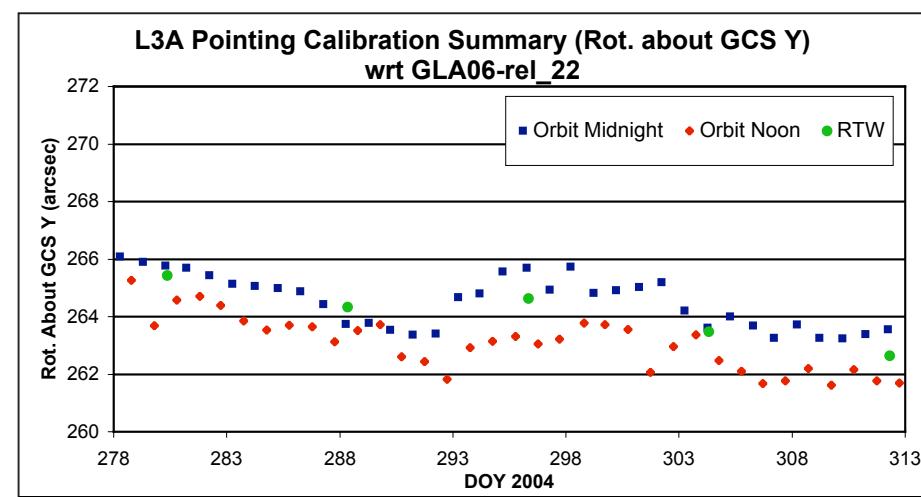
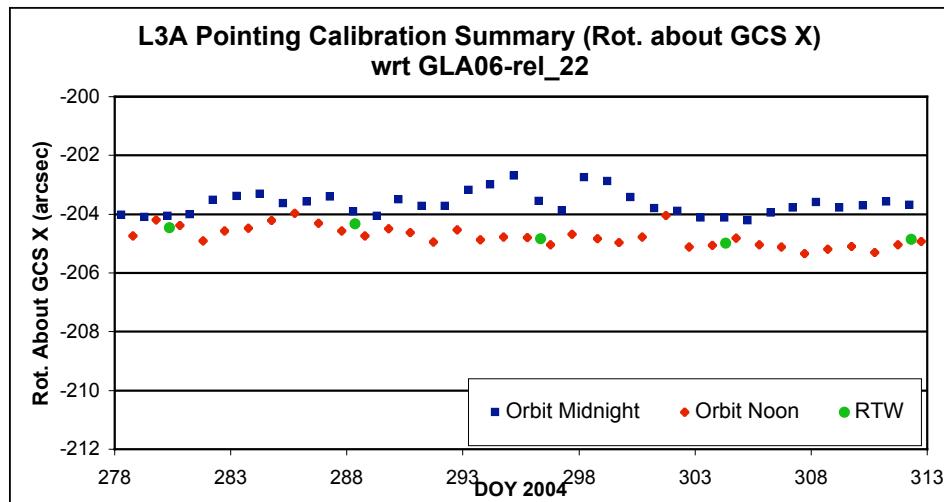


L2B SM Calibration Summary

L2B Rel. 22

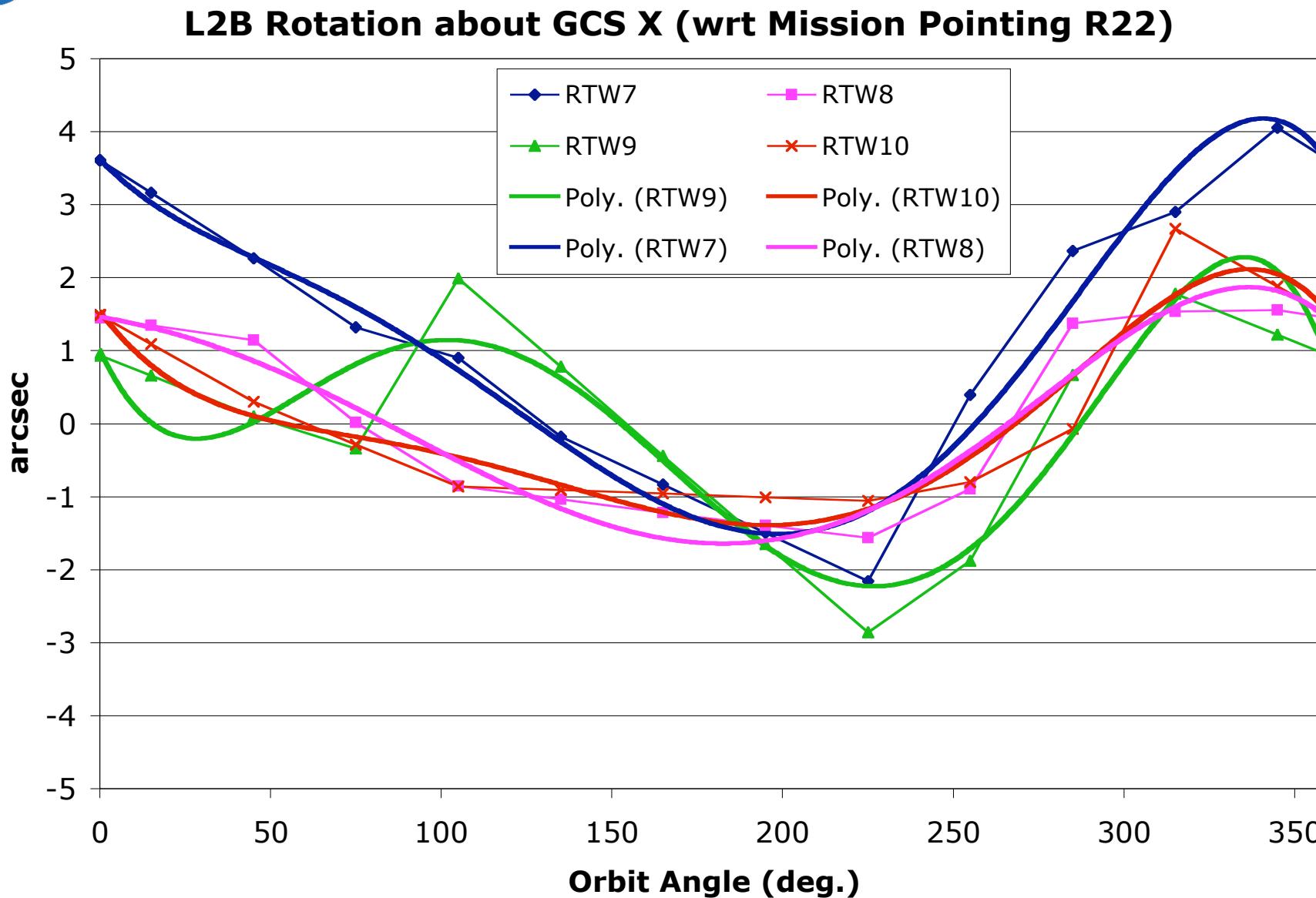


L3A Rel. 22





Remaining Orbital Variation Especially about GCS X





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L2B overall is similar to L2A, but further refinements will be explored especially for Greenland.



L2B Status

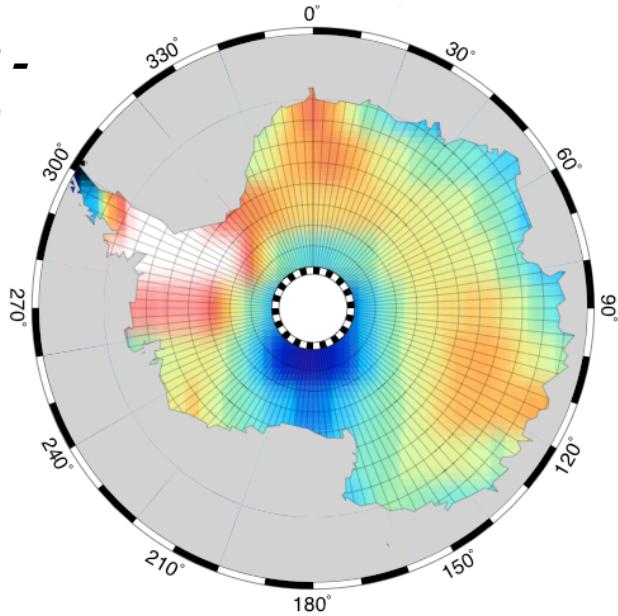
Remaining systematic errors in L2B Rel 22 are similar to L3A Rel. 22.

However, as we have seen, correcting these errors in L3A made an important improvement to the geolocation accuracy.

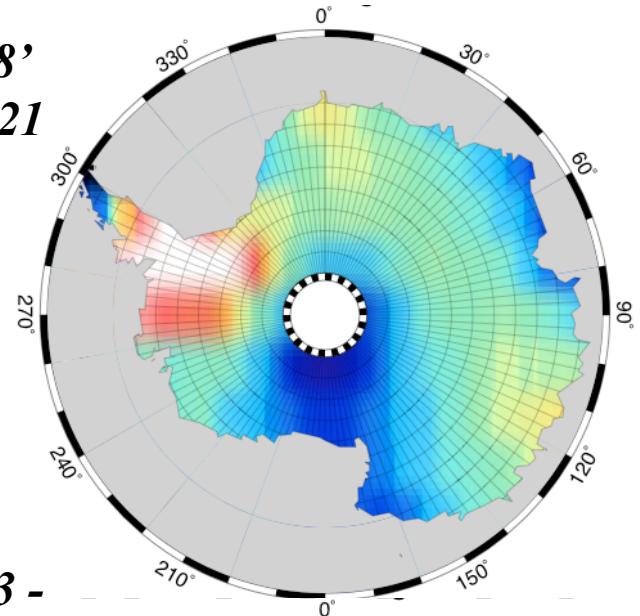


Pointing Impact on dh/dt

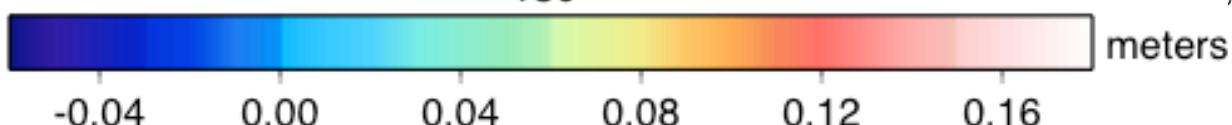
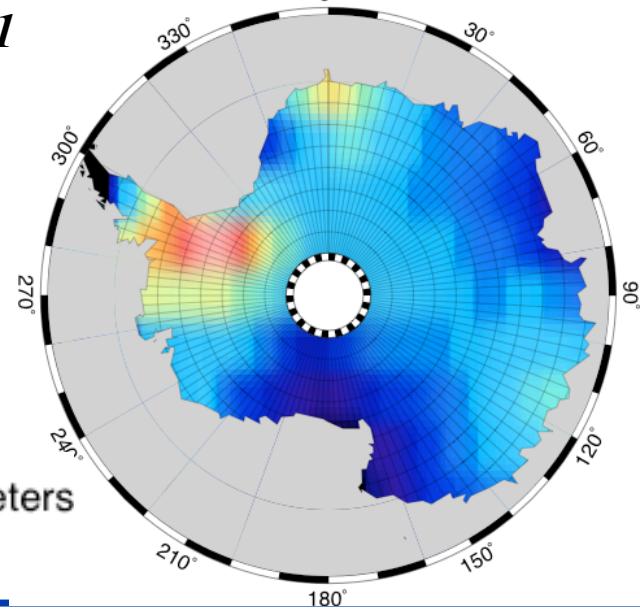
*L3A Rel18 -
L2A Rel19*



*L3A Rel18' -
L2A Rel21*



*L3A Rel23 -
L2A Rel21*





Impact of Atm. Press. Error on GRACE Inversion

Atm. Pressure Error modeled as difference between:

3hr ECMWF derived and 6hr. NCEP derived

Simulation - full GRACE gravity inversion for July03.

